Homework 4

Problem 2

Part a)

There are 60 minutes of arc in 1 degree and 60 seconds of arc in 1 minute of arc. Therefore:

$$10^0 = 10^0 \times \frac{60'}{1^0} \times \frac{60''}{1'} = 36000'' \tag{1}$$

Part b)

$$0.01 \times \frac{180^0}{\pi} \times \frac{60'}{1^0}\frac{60''}{1'} = 2062.6'' \tag{2}$$

Problem 3

Before we proceed to the solution to this problem we will outline somethings about stellar parallax.

1. When using the skinny triangle approximation, which is an excellent one for stellar distances, you should keep in mind that $\tan(\alpha) \simeq \alpha$, where α is measured in radians. Now, another important issue is that radians are units which do not have any significant physical importance. Therefore when you

equate something to an angle measured in radians, this quantity has to be unitless. A unitless quantity could be a fraction of quantities with the same physical interpretation. In our case these quantities are distances. So, in order to yield a unitless fraction of distances these distances have to be measured in the same units. If the numerator is in cm then the denominator should be in cm.[1] If the numerator is in AU then the denominator should be in AU etc.

2. Keeping all these in mind when using the stellar annual parallax formula[2]

$$\alpha[radians] = \frac{1\ AU}{D} \tag{3}$$

the distance D to the star has to be measured in AUs in order for the right hand side of eq. 3 to yield a unitless quantity.

3. Degrees, arcminutes and arcseconds have the same significance as radians, so if you want to measure parallax in arcseconds the correct formula to use is:

$$\alpha[arcseconds] = \frac{1}{D[pc]} \tag{4}$$

Now, let us focus on the actual problem of homework set 4.

a) Since the parallax is given in arcseconds it will be easier to use eq. 4: then the distance to the star will be:

$$D[pc] = \frac{1}{\alpha[arcseconds]} = \frac{1}{0.1} \Rightarrow D = 10\ pc \tag{5}$$

[1] In order to receive full credit for a problem, you must indicate the units. E.g., an anser of "10" is only correct if you also give the units, say 10 pc, 10 years, 10 apples, etc.

[2] Square brackets do not mean argument of a function, but that the quantity is measured in the units specified within them

b) Since the distance to the star is given in parsecs[3] it is easier to use eq. 4 to obtain the parallax:

$$\alpha[''] = \frac{1}{D[pc]} = \frac{1}{30} \Rightarrow \alpha \simeq 0.033'' \tag{6}$$

[3]The name of the unit parsec comes from the words **par**allax **sec**ond